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FILED WITH SMALL ENTITY STATUS**

# **SKATEBOARD HAVING A THREE-DIMENSIONAL INDEPENDENT SUSPENSION BALANCE SYSTEM**

## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention**

The present invention relates to a skateboard having a three-dimensional independent suspension balance system, and more particularly to a skateboard, wherein each of the rollers has independent horizontal and vertical displacement, thereby forming an excellent balance effect, so that the skateboard can be moved in a stable manner.

### **2. Description of the Related Art**

A first conventional skateboard 10B in accordance with the prior art shown in Figs. 15-17 comprises a board body 11B, two bases 12B each mounted on the bottom of the board body 11B, and two wheel seats 13B each mounted on the bottom of a respective one of the two bases 12B for supporting two rollers 14B by a wheel axle 15B.

However, the first conventional skateboard 10B has the following disadvantages.

1. Each of the two wheel seats 13B can be rotated through a little angle only, thereby causing instability when the skateboard 10B is turned, and thereby affecting the user's safety.

2. As shown in Fig. 15, each of the two wheel seats 13B can be rotated through a little angle only, so that the rotation diameter "R" of the

1 board body 11B is very large, thereby decreasing mobility of the skateboard  
2 10B when turning.

3 3. As shown in Fig. 16, when either one roller 14B is blocked, the  
4 roller 14B produces a height differential  $\Delta H$ , and the board body 11B produces  
5 a larger height differential  $\Delta H'$ , thereby decreasing stability of the skateboard  
6 10B when moving.

7 4. When the rollers 14B are subjected to shock or vibration, the shock  
8 or vibration is directly transmitted to the board body 11B, thereby causing an  
9 uncomfortable sensation to the user.

10 5. As shown in Fig. 17, when either roller 14B is blocked, one of the  
11 two wheel seats 13B is deflected and directed toward the direction "D1" which  
12 deviates from the travel direction "D0" of the skateboard 10B, thereby  
13 decreasing stability of the skateboard 10B when moving.

14 A second conventional skateboard 10C in accordance with the prior  
15 art shown in Figs. 18 and 19 comprises a board body 11C, and two bases 12C  
16 each mounted on the bottom of the board body 11C. Each of the two bases 12C  
17 is provided with a rotation disk 16C having two ends each pivoted with a  
18 primary wheel arm 17C which is provided with a roller 14C. The primary  
19 wheel arm 17C has a mediate portion provided with a secondary wheel arm  
20 18C which is pivotally connected with a drawing arm 19C which is extended  
21 through the base 12C.

1           However, the second conventional skateboard 10C has the following  
2   disadvantages.

3           1. The second conventional skateboard 10C is expensive, thereby  
4   increasing costs of fabrication.

5           2. The second conventional skateboard 10C has a heavy weight and a  
6   large volume, thereby causing inconvenience to the user in transportation and  
7   storage.

8           3. The primary wheel arm 17C is interconnected with the secondary  
9   wheel arm 18C, thereby affecting displacement of the roller 14C at the other  
10   end, and thereby decreasing stability of the skateboard 10C when moving.

11           4. The second conventional skateboard 10C has a higher center of  
12   gravity, thereby decreasing stability of the skateboard 10C when moving.

13           5. Each of the rollers 14C is distantly spaced from the board body  
14   11C, so that the user's one foot easily hits the roller 14C, thereby causing  
15   inconvenience in use.

16           The closest prior art references of which the applicant is aware are  
17   disclosed in U.S. Patent No. 5,263,725 and U.S. Patent No. 5,997,018.

### 18           **SUMMARY OF THE INVENTION**

19           The primary objective of the present invention is to provide a  
20   skateboard having a three-dimensional independent suspension balance  
21   system.

1 Another objective of the present invention is to provide a skateboard,  
2 wherein each of the rollers has independent horizontal and vertical  
3 displacement, thereby forming an excellent balance effect, so that the  
4 skateboard can be moved in a stable manner.

5 A further objective of the present invention is to provide a skateboard,  
6 wherein the main seat can be rotated relative to the base, so that when the board  
7 body is pressed, the main seat restoring device can be compressed or loosened,  
8 and the main seat can be deflected, so as to produce a smaller rotation diameter,  
9 thereby enhancing movability of the skateboard when turning.

10 A further objective of the present invention is to provide a skateboard,  
11 wherein when a single roller is blocked by an obstruction, the roller can adjust  
12 its position automatically, so that the roller is rotated about the wheel seat pivot  
13 shaft to deflect upward. Thus, the board body maintain a horizontal state to  
14 move in the forward direction stably, thereby enhancing stability of the  
15 skateboard when moving.

16 A further objective of the present invention is to provide a skateboard,  
17 wherein when the rollers are subjected to shock or vibration, the main seat  
18 restoring device and the two wheel seat restoring devices provide a cushioning  
19 effect to prevent the shock or vibration from being transmitted to the base or  
20 the main seat, thereby providing a shock absorbing and cushioning effect.

1           A further objective of the present invention is to provide a skateboard,  
2   wherein the board body is moved in a stable manner, thereby enhancing safety  
3   of the skateboard when moving.

4           A further objective of the present invention is to provide a skateboard,  
5   wherein the main seat can be rotated relative to the base and each of the two  
6   wheel seats can be rotated relative to the main seat, thereby producing a  
7   three-dimensional movement, and thereby enhancing versatility of the  
8   skateboard.

9           A further objective of the present invention is to provide a skateboard,  
10   wherein the skateboard has an excellent balance effect by design of the main  
11   seat restoring device and the two wheel seat restoring devices.

12           In accordance with the present invention, there is provided a  
13   skateboard comprising:

14           a board body having a bottom provided with a base;  
15           the base having a bottom provided with two opposite wheel seats;  
16           each of the two wheel seats including a wheel axle for mounting a  
17   roller;

18           wherein, the wheel axle of each of the two wheel seats has a center  
19   located at a height different from that of a center of the respective wheel seat,  
20   thereby forming an eccentric state, so that each roller has independent  
21   horizontal and vertical displacement.

1 Further benefits and advantages of the present invention will become  
2 apparent after a careful reading of the detailed description with appropriate  
3 reference to the accompanying drawings.

#### 4 **BRIEF DESCRIPTION OF THE DRAWINGS**

5 Fig. 1 is a partially cut-away perspective view of a skateboard in  
6 accordance with the preferred embodiment of the present invention;

7 Fig. 2 is a perspective view of the skateboard in accordance with the  
8 preferred embodiment of the present invention;

9 Fig. 3 is a partially exploded perspective view of the skateboard in  
10 accordance with the preferred embodiment of the present invention;

11 Fig. 4 is a front plan cross-sectional assembly view of the skateboard  
12 as shown in Fig. 3;

13 Fig. 5 is a partially cut-away side plan cross-sectional assembly view  
14 of the skateboard as shown in Fig. 3;

15 Fig. 6 is a partially cut-away side plan cross-sectional assembly view  
16 of the skateboard as shown in Fig. 3;

17 Fig. 7 is a schematic operational view of the skateboard as shown in  
18 Fig. 4 in use;

19 Fig. 8 is a partially cut-away schematic bottom plan operational view  
20 of the skateboard as shown in Fig. 2 in use;

21 Fig. 9 is a schematic plan operational view of the skateboard in  
22 accordance with the preferred embodiment of the present invention;

1           Fig. 10 is a schematic bottom plan operational view of the skateboard  
2   as shown in Fig. 2 in use;

3           Fig. 11 is a schematic operational view of the skateboard as shown in  
4   Fig. 6 in use;

5           Fig. 12 is a schematic operational view of the skateboard as shown in  
6   Fig. 9 in use;

7           Fig. 13 is a partially cut-away schematic bottom plan operational  
8   view of the skateboard as shown in Fig. 2 in use;

9           Fig. 14 is an exploded perspective view of a skateboard in  
10   accordance with another embodiment of the present invention;

11          Fig. 15 is a schematic plan operation view of a first conventional  
12   skateboard in accordance with the prior art;

13          Fig. 16 is a side plan operation view of the first conventional  
14   skateboard in accordance with the prior art;

15          Fig. 17 is a schematic plan operation view of the first conventional  
16   skateboard in accordance with the prior art;

17          Fig. 18 is a front plan view of a second conventional skateboard in  
18   accordance with the prior art; and

19          Fig. 19 is a side plan view of the second conventional skateboard in  
20   accordance with the prior art.

21           **DETAILED DESCRIPTION OF THE INVENTION**



1           Referring to the drawings and initially to Figs. 1-6, a skateboard 10  
2   having a three-dimensional independent suspension balance system in  
3   accordance with the preferred embodiment of the present invention comprises  
4   a board body 11 having a bottom having a front end and a rear end each  
5   provided with a base 20. The base 20 has a top formed with a fixing portion 21  
6   fixed on the board body 11. The base 20 has a bottom provided with two  
7   opposite wheel seats 30. Each of the two wheel seats 30 includes a wheel axle  
8   31 for mounting a roller 33 by a bearing 32. An adjusting member 23 is  
9   mounted between the board body 11 and the fixing portion 21 of the base 20  
10   for adjusting the distance between the board body 11 and the base 20, so as to  
11   fit rollers 33 of different diameters.

12           The center of the wheel axle 31 of each of the two wheel seats 30 is  
13   located at a height different from that of the center of the respective wheel seat  
14   30, thereby forming an eccentric state, so that each roller 33 has independent  
15   horizontal and vertical displacement, thereby providing a steady buffering  
16   effect during movement.

17           The skateboard 10 further comprises a main seat 40 mounted  
18   between the base 20 and the two wheel seats 30. Preferably, the main seat 40  
19   has a top rotatably mounted on the base 20 by a base pivot shaft 70, and each of  
20   the two wheel seats 30 is rotatably mounted on a bottom of the main seat 40 by  
21   a wheel seat pivot shaft 80. The wheel axle 31 of each of the two wheel seats 30  
22   is located at a height different from that of the respective wheel seat pivot shaft

80, thereby forming an eccentric state, so that each roller 33 on the wheel axle 31 has independent horizontal and vertical displacement and has independent buffer displacement, thereby providing a steady buffering effect during movement.

The skateboard 10 further comprises a main seat restoring device 50 mounted between the base 20 and the main seat 40 to provide a shock-absorbing effect to the base 20 and the main seat 40, and two wheel seat restoring devices 60 each mounted between the main seat 40 and a respective one of the two wheel seats 30 to provide a shock-absorbing effect to the main seat 40 and the respective wheel seat 30.

The top of the main seat 40 is formed with a base receiving portion 41. The bottom of the base 20 is formed with an inverted V-shaped connecting portion 22 rotatably mounted on the base receiving portion 41 of the main seat 40.

The connecting portion 22 of the base 20 has a first side rotatably mounted on a first side of the base receiving portion 41 of the main seat 40. Preferably, the first side of the base receiving portion 41 of the main seat 40 is formed with an arcuate guide edge 410, and the first side of the connecting portion 22 of the base 20 is formed with an arcuate guide edge 220 rested on the guide edge 410 of the base receiving portion 41, so that the connecting portion 22 of the base 20 is rotated on the base receiving portion 41 of the main seat 40 conveniently.

1           The connecting portion 22 of the base 20 has a second side provided  
2   with an urging portion 221 having a distal end formed with a protruding  
3   retaining edge 222. The base receiving portion 41 of the main seat 40 has a  
4   second side provided with a U-shaped urging portion 411.

5           The main seat restoring device 50 is clamped between the urging  
6   portion 221 of the connecting portion 22 of the base 20 and the urging portion  
7   411 of the base receiving portion 41 of the main seat 40 and is retained by the  
8   retaining edge 222, so that the main seat 40 has an automatically restoring  
9   function. Preferably, the main seat restoring device 50 includes a restoring  
10  member 51 made of an elastic block.

11          As shown in Figs. 3 and 5, the base pivot shaft 70 is extended  
12  through the first side of the connecting portion 22 of the base 20 and the first  
13  side of the base receiving portion 41 of the main seat 40 and has a distal end  
14  screwed with a fixing member 71 (such as a nut), so that the main seat 40 can  
15  be rotated on the base 20 about the base pivot shaft 70. The skateboard 10  
16  further comprises a bushing 72 made of wear-resistant material mounted on the  
17  base pivot shaft 70 and located between the first side of the connecting portion  
18  22 of the base 20 and the first side of the base receiving portion 41 of the main  
19  seat 40 to decrease friction between the base pivot shaft 70, the base 20 and the  
20  main seat 40.

21          As shown in Figs. 3 and 4, each of the two wheel seats 30 has a  
22  mediate portion formed with a shaft passage portion 34 having a center formed

1 with a shaft hole 340. The wheel seat pivot shaft 80 is extended through the  
2 shaft hole 340 of the shaft passage portion 34 of each of the two wheel seats 30  
3 and through the main seat 40 and has two ends each protruding outward from a  
4 respective one of the two wheel seats 30 and each screwed with a threaded  
5 fixing member 81 (such as a nut). Thus, each of the two wheel seats 30 can be  
6 rotated on the main seat 40 about the wheel seat pivot shaft 80. Preferably, a  
7 bushing 82 is mounted between the wheel seat pivot shaft 80 and the fixing  
8 member 81. In addition, the wheel axle 31 of each of the two wheel seats 30 is  
9 located at a height different from that of the respective wheel seat pivot shaft  
10 80, thereby forming an eccentric state, so that each roller 33 on the wheel axle  
11 31 has independent horizontal and vertical displacement during rotation of the  
12 respective wheel seat 30, thereby providing a steady buffering effect during  
13 movement.

14 As shown in Figs. 3-6, the bottom of the main seat 40 has two ends  
15 each provided with a wheel seat receiving portion 42. The wheel seat receiving  
16 portion 42 of the main seat 40 has a first end formed with a guide channel 420,  
17 a second end formed with a receiving channel 421, and a mediate portion  
18 formed with a partition 424 located between the guide channel 420 and the  
19 receiving channel 421.

20 Each of the two wheel seats 30 is mounted in the wheel seat receiving  
21 portion 42 of the main seat 40 and has a first end formed with a protruding  
22 restoring portion 35 movably mounted in the guide channel 420 of the wheel

1 seat receiving portion 42 of the main seat 40. Each of the two wheel seats 30  
2 has a second end for passage of the respective wheel axle 31. The restoring  
3 portion 35 of each of the two wheel seats 30 has a first side formed with a  
4 locking edge 352 that can be moved to abut a wall of the guide channel 420 of  
5 the wheel seat receiving portion 42 of the main seat 40 as shown in Fig. 6 and a  
6 second side formed with a resting edge 351 that can be moved to abut the  
7 partition 424 of the wheel seat receiving portion 42 of the main seat 40 as  
8 shown in Fig. 11.

9 Each of the two wheel seat restoring devices 60 is mounted in the  
10 wheel seat receiving portion 42 of the main seat 40.

11 Each of the two wheel seat restoring devices 60 includes a restoring  
12 member 61 mounted in the receiving channel 421 of the wheel seat receiving  
13 portion 42 of the main seat 40 and urged between the partition 424 and a wall  
14 of the receiving channel 421, and an urging seat 63 movably mounted in the  
15 receiving channel 421 of the wheel seat receiving portion 42 of the main seat  
16 40 and having a first side formed with a fixing portion 630 fixed on a first end  
17 of the restoring member 61 and a second side formed with an urging portion  
18 631 urged on the resting edge 351 of the restoring portion 35 of the respective  
19 wheel seat 30. Preferably, the urging seat 63 is rested on the partition 424 of the  
20 wheel seat receiving portion 42 of the main seat 40, and the urging portion 631  
21 of the urging seat 63 is extended through the partition 424 of the wheel seat  
22 receiving portion 42 of the main seat 40.

1           Each of the two wheel seat restoring devices 60 further includes an  
2   adjusting seat 65 movably mounted in the receiving channel 421 of the wheel  
3   seat receiving portion 42 of the main seat 40 and having a first side formed  
4   with a fixing portion 650 fixed on a second end of the restoring member 61 and  
5   a second side rested on a wall of the receiving channel 421 of the wheel seat  
6   receiving portion 42 of the main seat 40.

7           Each of the two wheel seat restoring devices 60 further includes an  
8   adjusting screw 62 screwed into the wall of the receiving channel 421 of the  
9   wheel seat receiving portion 42 of the main seat 40 and having an end formed  
10   with an urging face 621 urged on the second side of the adjusting seat 65.  
11   Preferably, the second side of the adjusting seat 65 is formed with a depression  
12   651 to receive the urging face 621 of the adjusting screw 62. Thus, the  
13   adjusting screw 62 can be rotated to urge and move the adjusting seat 65 to  
14   compress the restoring member 61 so as to adjust the tension of the restoring  
15   member 61.

16           Accordingly, the skateboard 10 in accordance with the present  
17   invention has the following advantages.

18           1. The main seat 40 can be rotated relative to the base 20, so that  
19   when the board body 11 is pressed, the main seat restoring device 50 between  
20   the base 20 and the main seat 40 can be compressed as shown in Figs. 7-9 to  
21   provide a shock-absorbing effect to the base 20 and the main seat 40, and the  
22   main seat 40 can be deflected from the axis  $L_0$  to the axis  $L_1$  to produce a

1 deflection angle  $\theta$  as shown in Fig. 10, so as to produce a smaller rotation  
2 diameter "r", thereby enhancing mobility of the skateboard 10 when turning.

3 2. When either roller 33 is blocked by an obstruction, the roller 33  
4 can be deflected to produce different displacement as shown in Figs. 11 and 12  
5 to adjust its position automatically, so that the roller 33 is rotated about the  
6 wheel seat pivot shaft '80 to deflect upward through the height of " $\Delta h$ " as  
7 shown in Figs. 11 and 12. In such a manner, the roller 33 is moved back from  
8 the axis  $L_1$  to the axis  $L_2$  to produce a delay  $\Delta S$  deflection angle  $\theta$  as shown in  
9 Fig. 13. Thus, the board body 11 maintain a horizontal state, so as to move in  
10 the forward direction "D0" stably as shown in Fig. 13, thereby enhancing  
11 stability of the skateboard 10 when moving.

12 3. When the rollers 33 are subjected to shock or vibration, the main  
13 seat restoring device 50 and the two wheel seat restoring devices 60 provide a  
14 cushioning effect to prevent the shock or vibration from being transmitted to  
15 the base 20 or the main seat 40, thereby providing a shock absorbing and  
16 cushioning effect.

17 4. The board body 11 is moved in a stable manner, thereby enhancing  
18 safety of the skateboard 10 when moving.

19 5. The main seat 40 can be rotated relative to the base 20 and each of  
20 the two wheel seats 30 can be rotated relative to the main seat 40, thereby  
21 producing a three-dimensional movement, and thereby enhancing versatility of  
22 the skateboard 10.

1           6. The skateboard 10 has an excellent balance effect by design of the  
2   main seat restoring device 50 and the two wheel seat restoring devices 60.

3           Referring to Fig. 14, a skateboard 10A having a three-dimensional  
4   independent suspension balance system in accordance with another  
5   embodiment of the present invention is shown, wherein the second end of each  
6   of the two wheel seats 30A is provided with an extension arm 36 extended  
7   from the shaft passage portion 34 for passage of the respective wheel axle 31  
8   so as to match the roller 33A of a larger size.

9           Although the invention has been explained in relation to its preferred  
10   embodiment(s) as mentioned above, it is to be understood that many other  
11   possible modifications and variations can be made without departing from the  
12   scope of the present invention. It is, therefore, contemplated that the appended  
13   claim or claims will cover such modifications and variations that fall within the  
14   true scope of the invention.

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